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Cytotaxonomical remarks on *Allium pallens* and its relationships with *A. convallarioides* (*Alliaceae*)

Abstract

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Taxonomy, karyology, chorology and ecology of *A. pallens* L., a circummediterranean species occurring in synanthropic habitats, are examined. It is closely related to *A. convallarioides* Grossh., a diploid species linked to natural habitats, which can be considered its probable ancestor.

Introduction

Within *Allium* sect. *Codonoprasum* Reichenb., *A. pallens* L. is a critical species, often taxonomically misidentified in the European and Mediterranean Floras. Herbarium and field investigations allowed to clarify the taxonomical aspects and the relationships with allied species.

According to Brullo & al. (1996a, 1996b), *A. pallens* is a synanthropic species, widespread in the Mediterranean range, occurring in field crops, uncultivated lands, road sides, meadows and clearings of the maquis where it flowers in early summer.

On the whole, *A. pallens* seems to be allied to *A. convallarioides* Grossh. in having similar habit, globose umbel, spathe valves unequal and longer than the umbel, campanulate perigon with white and small tepals, anthers exserted. All these characters approach the two species to some ones of *A. staticiforme* Sm. group, and, in particular, to *A. myrianthum* Boiss.

In order to emphasize the relationships among these species, morphological and karyological investigations were carried out on living material coming from several Mediterranean localities.

Materials and methods

The investigation was based on specimens collected in Spain, Italy, France, Greece, Turkey and Morocco and cultivated in the Botanic Garden of Catania University. In addition, material from various herbaria was examined (ATH, B, BC, BCF, BM, BOLO, CAT, FI,

FI-WEBB, G, G-BOISS, HJU, ISTE, K, LINN, M, MA, MPU, NAP-TEN, OXF, P, PA, PI, PR, PRC, RO, SEV, W, WU).

For karyological investigations, root-tips of bulbs were pre-treated with 0,3% colchicine, fixed in Carnoy and stained according to Feulgen technique. The studied po-pulations are listed in Table 1.

Table 1. List of karyologically studied populations.

A. pallens	Biancavilla	Sicily	2n=32
	San Giacomo	Sicily	2n=32
	Levanzo	Sicily	2n=32
	Lampedusa	Sicily	2n=32
	Trebisacce	Calabria	2n=32
	Gallipoli	Apulia	2n=32
	Magliano Sabina	Latium	2n=32
	Livorno	Tuscany	2n=32
	Marseille	France	2n=32
	Cadiz	Spain	2n=32
	Castillo de Locuba	Spain	2n=32
	Majorca	Spain	2n=32
	Kavala	Greece	2n=32
	Delphi	Greece	2n=32
	Mycene	Greece	2n=32
	Didime	Turkey	2n=32
	Anti Atlas, Igrem	Morocco	2n=32
A. convallarioides	Manisa Dag	Turkey	2n=16
	Menemenciz (Izmir)	Turkey	2n=16

Results and discussion

1) *Allium pallens* L., Sp. Pl. ed. 2, 427, 1762 (Fig. 1)

Lectotypus: LINN 419.20 proposed here.

Syn.: *A. coppoleri* Tineo, Cat. Pl. Horti Panorm.: 275, 1827
Lectotypus: Villabate, *Tineo* (FI!) proposed here.

A. collinum Guss. in Ten., Fl. Neap. Syll.:169, 1831
Lectotypus: Calabria, *Guss.* (NAP!) proposed here.

A. amblyanthum Zahariadi, Biol. Gallo-Hellen. 6(1): 53, 1975
Holotypus : Kifissia, Attica, VI.1974, *Embiricos* (ATH)

A. stearnii Pastor & Valdés, Rev. Allium Penins. Iber. Is. Balear.: 86, 1983
Holotypus: Cordoba prope El Tejar, ubi die, 7.VII.1982, *Pastor & Valdés 77594* (SEV!)

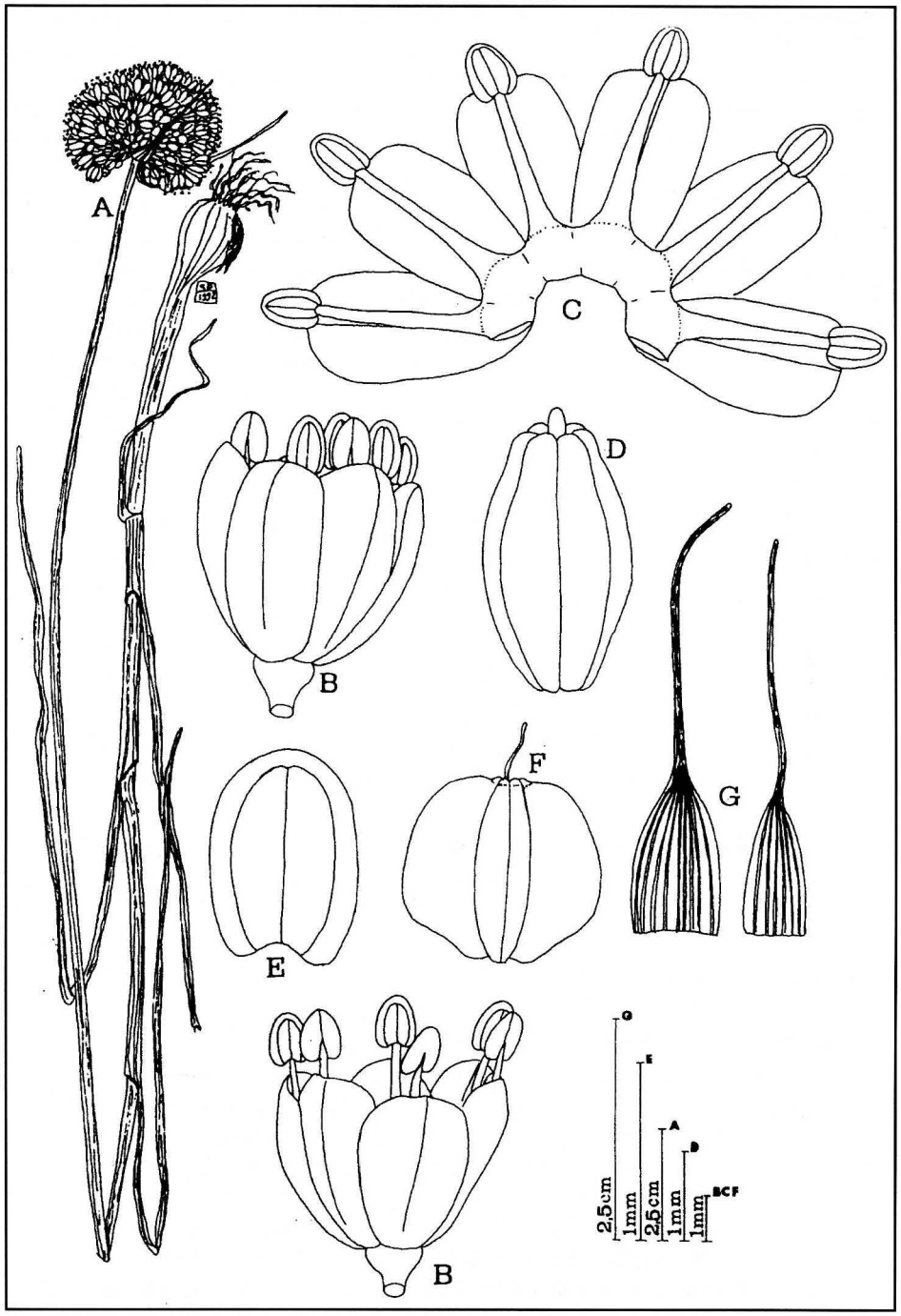

Fig. 1. *Allium pallens* L. A: habit; B: flower; C: perigon with stamens; D: ovary; E: anther; F: capsule; G: spathe valves.

Bulb ovoid or subglobose, 15-25 x 10-20 mm, sometimes bulbilliferous, with membranous whitish tunics, the outer often dark brown. Stem (15-)20-70(-90) cm high, cylindrical, glabrous, erect, covered for ½ of its length by the leaf sheaths. Leaves 4-6, semicylindrical, glabrous, green, ribbed, fistulous, up to 25 cm long and 1,5-3 mm wide. Spathe persistent, with 2 valves unequal, longer than the inflorescence, 6-10-nerved, the larger 2-12(-15) mm long, the smaller 1-6(-10) mm long. Bostryces 12. Inflorescence globose, rarely globose-ovoid, 2,5-5 cm in diameter, dense, many-flowered, with subequal pedicels 5-25 mm long. Perigon campanulate, with tepals equal, white, rarely pinkish-white, elliptical-oblong to oblong-ovate, truncate or subobtuse at the apex, sometimes shortly apiculate, 4-4,5 mm long and 1,2-2,5 mm wide, midrib vanishing greenish-white. Stamens exserted from perigon, sometimes subequal to tepals, with simple white filaments, subequal, 2,5-4 mm long, below connate into an annulus 1 mm high. Anthers yellow, elliptical, 1,2-1,3 x 0,8-1 mm, rounded at the apex. Ovary ellipsoid, green, smooth, 3-4 x 1,2-2 mm, slightly throated in the upper part. Style white, 0,7-2 mm long. Capsule trivalved, subglobose to subglobose-ovoid, 4-4,5 x 4-4,5 mm.

Ecology

A. pallens generally occurs in nitrophylous habitats as cultivated or abandoned fields (vineyards, olive-grove), and along road edges, sometimes in natural environments as garigues, maquis and meadows too.

Geographical distribution

This species is widespread in the Mediterranean area, in particular Portugal, Spain, Baleares, France, Italy, Sicily, Greece, Aegean Islands, Cyprus, W and S Turkey, Syria, Lebanon, Israel, Egypt, Tunisia, Algeria, Morocco (Fig. 2).

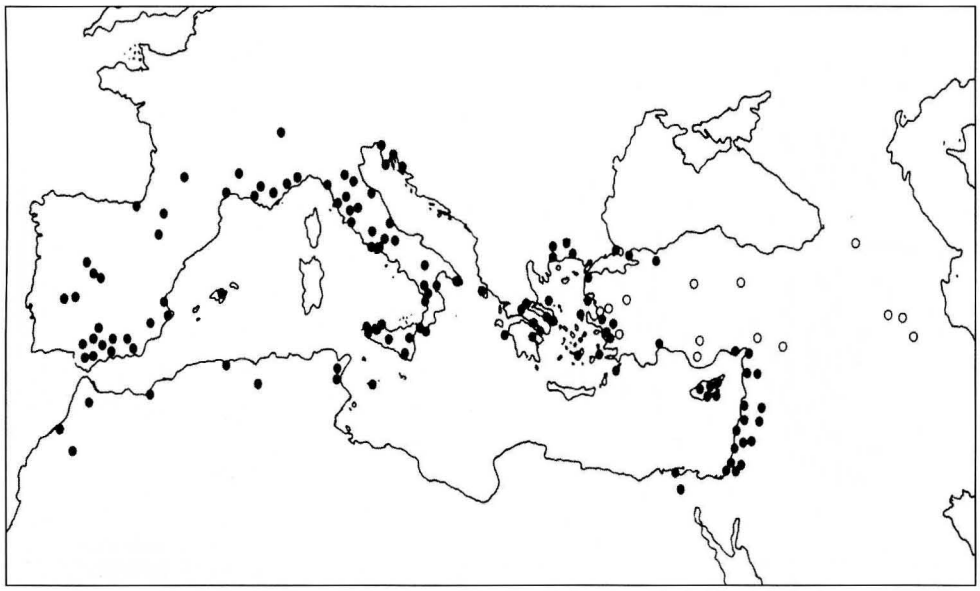

Fig. 2. Geographical distribution of *A. pallens* (dots) and *A. convallarioides* (circles).

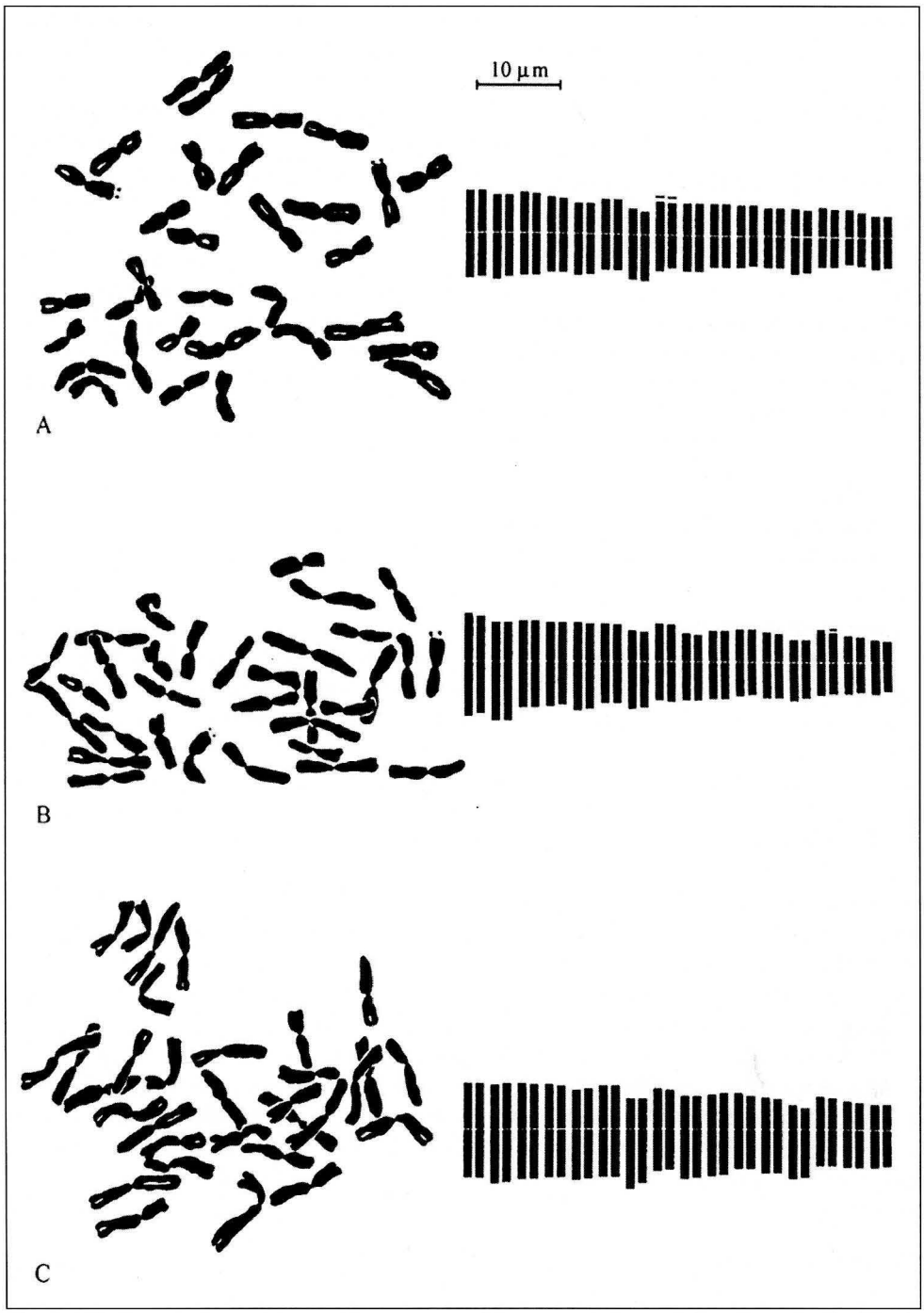

Fig. 3. Mitotic metaphase plates and karyograms of three populations of *A. pallens*. A: Castillo de Locuba; B: Cadiz; C: Levanzo.

Karyology

For the karyological study, populations coming from several localities of Mediterranean range were examined (Table 1).

All the observed material shows a chromosome complement 2n=32 (Fig. 3). Therefore *Allium pallens* is a tetraploid species, but four homologous sets of chromosomes were not pointed out. In particular, the karyotype is characterized by 14 metacentric pairs, some of them microsatellited, and two submetacentric pairs.

The chromosome formula is 2n=4x=32: 26 m + 2 m^t + 4sm.

Taxonomic remarks

Allium pallens was described by Linnaeus (1762) who emphasizes in the protologue:

pallens. 18. ALLIUM caule subteretifolio umbellifero, floribus pendulis truncatis, staminibus simplicibus corollam aequantibus.

Allium umbella non bulbifera lutea, vagina bicornis, foliis teretibus. *Hall. all. 21.*

Allium montanum bicorne, flore pallido odoro. *Bauh. pin. 75.*

Gethioides sylvestre. *Colum. ecphr. 2. p. 6. t. 7. f. 2.*

Caulis *bipedalis, teres, laevis.* Folia *alterna, semiteretia, fistolosa, eptagona, erecta.* Spata *subulata, nervosa.* Corolla *campanulata, truncata, alba.* Petalis *obovatis, obtusissimis, erectis, concavis, carina viridi.* Stamina *simplicia, longitudine petalorum.* Flores *mox a florescentia pendent.* Stylus *vix ullus, post anthesin excrescens, brevissimus.*

As regards lectotypification of this Linnaean species, De Wilde Duyfjes (1973) choosed the specimen S 139.9, conserved in the Linnaean Herbarium in Stockholm as type, pointing out that this specimen came from central part of Asia corresponding to the Middle East, as means the sign ⊖. This lectotypification is not acceptable because Linnaeus in the protologue does not quote Asia as origin of the species. Therefore, another lectotype must be designated. In the Linnaean Herbarium (London) is preserved an *Allium* LINN 419.20 with a label where it is annoted "n. 8 an *Allium pallens – revera styli non elongatus nisi prius stans deflorata*". The specimen of this sheet is characterized by a big size, bulb lacking, stem cylindrical, leaves ribbed, fistulous, spathe longer than inflorescence, plurinerved, some flowers pendulous, perigon campanulate, truncate, whitish, stamens subequal or slightly exserted from perigon, style short. These characters well agree with the description of the protologue and consequently LINN 419.20 is chosen as new lectotype of *A. pallens*.

On the basis of herbarium and literature investigations, it was possible to ascertain that this species was later described by Tineo (1827) sub *A. coppoleri* on material coming from a place near Palermo (Sicily) and by Gussone (Tenore 1831) sub *A. collinum* on specimens collected in S Calabria. Synonyms of *A. pallens* must also be considered *A. amblyanthum* described by Zahariadi (1975) from Greece and *A. stearnii* described by Pastor & Valdés (1983) from Spain.

2) *Allium convallarioides* Grossh. in Grossh. & Schischkin., Sched. Herb. Pl. Or. Exsicc. 1924: no. 107 (1924) (Fig. 4).

Lectotypus: Transcaucasia, pr. et dist. Erivan prope Dzhirvish in siccis, 20.7.1919, *Grossheim 107* (K!).

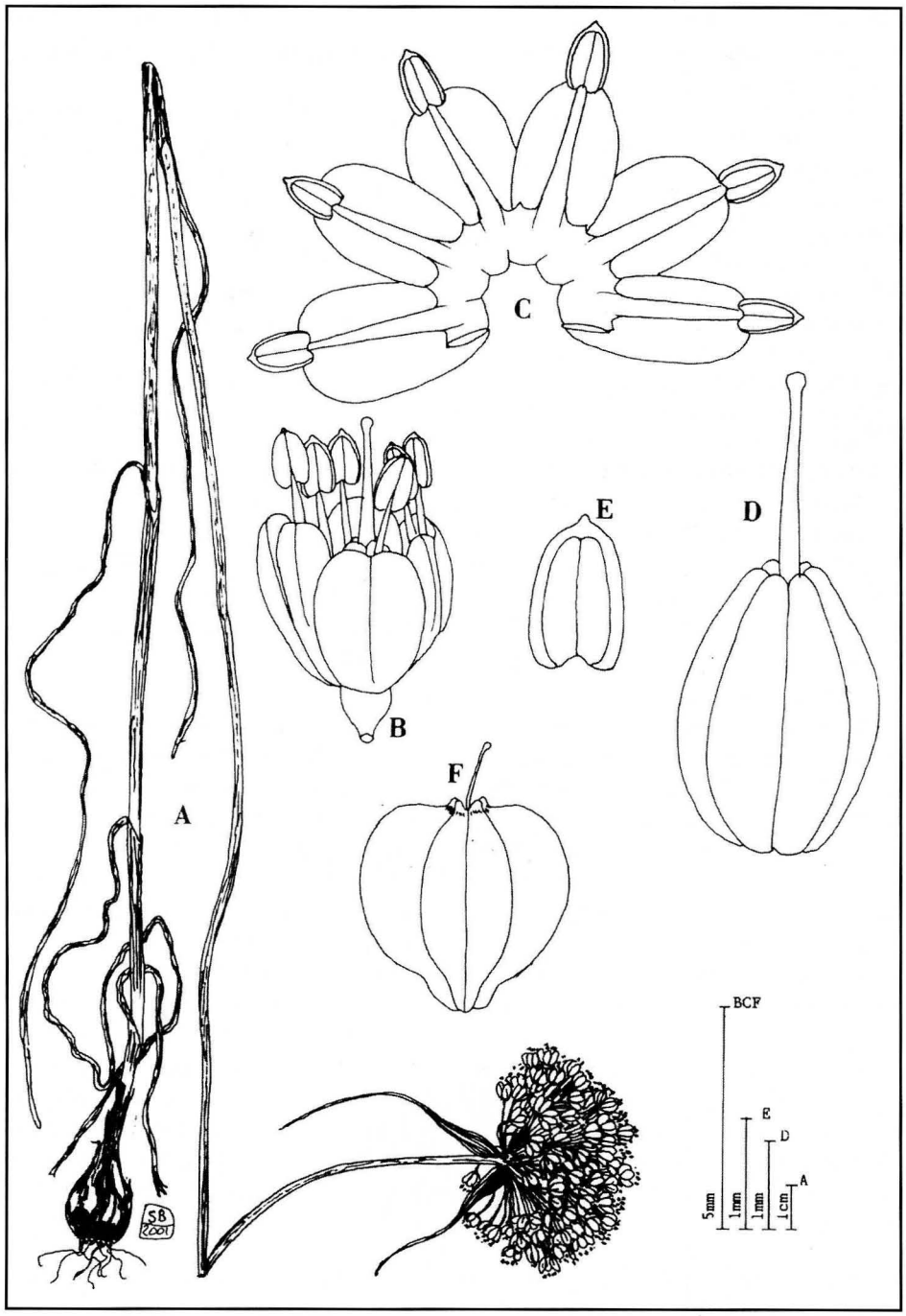

Fig. 4. *Allium convallarioides* Grossh. A: habit; B: flower; C: perigon with stamens; D: ovary; E: anther; F: capsule.

Bulb ovoid, 15-20 x 12-18 mm, sometimes bulbilliferous, with membranous whitish tunics, the outer often dark brown. Stem 40-70 cm high, cylindrical, glabrous, erect, covered for 1/3-1/2 of its length by the leaf sheaths. Leaves 4-5, semicylindrical, glabrous, green, ribbed, fistulous, up to 15 cm long and 1-2 mm wide. Spathe persistent, with 2 valves unequal, longer than the inflorescence, 5-7-nerved, the larger 4-5 mm long, the smaller 2,5-4,5 mm long. Bostryces 12. Inflorescence globose to subglobose, 3-5 cm in diameter, dense, many-flowered, with subequal pedicels 10-28 mm long. Perigon campanulate, with tepals equal, white, oblong, rounded at the apex, 3,5-4 mm long, the outer 2,2 mm wide, the inner 2 mm wide, midrib greenish-white. Stamens exserted from perigon, with simple white filaments, subequal, 2,5-3 mm long, below connate into an annulus 1,2-1,3 mm high with interstaminal teeth. Anthers yellow, elliptical, 1,2-1,3 x 0,7 mm, apiculate at the apex. Ovary ellipsoid, white tinged with green, smooth, 2,8-3 x 2-2,1 mm. Style white, 2-2,5 mm long. Capsule trivalved, subglobose-obovoid, 4,5 x 4,5 mm.

Ecology

A. convallarioides is normally linked to natural habitats as rocky places, garigues or steppe prairies.

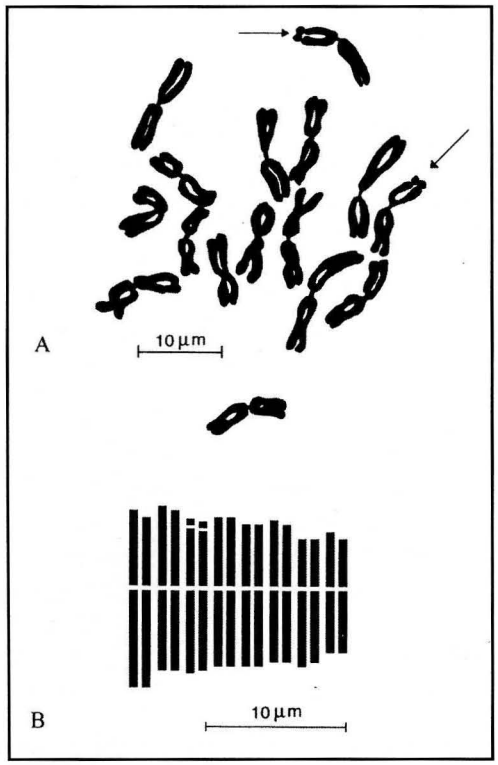

Fig. 5. Mitotic metaphase plates and karyograms of *A. convallarioides* from Manisa Dag.

Geographical distribution

At present this species seems to be circumscribed to some localities of the Middle East, extending eastwards to Iran. In particular it occurs in Anatolia, Caucasus, Iran and Iraq (Fig. 2).

Karyology

Allium convallarioides is a diploid species with 2n=16; its chromosome complement is quite homogeneous and shows 7 metacentric pairs, one of them macrosatellited on the short arm, and one submetacentric pair (Fig. 5). The chromosome formula can be resumed as 2n=2x=16: 12 m + 2 m^t + 2 sm.

The karyotype of this species is on the whole morphologically quite similar to that one of *A. pallens*.

Taxonomic remarks

Previously *A. convallarioides* was doubtfully considered by Kollmann (1984) as a synonym of *A. myrianthum* Boiss. due to the globose inflorescence and stamens exserted from the perigon, apart for the big size. Morphological and karyological study carried on living material from a lot of localities, including its *locus classicus*, emphasized that *A. myrianthum* is well differentiated from *A. convallarioides* (Brullo & al. 1995). There are also remarkable differences from the ecological point of view, because *A. myrianthum* is a species linked to damp soils of thermal springs and marshes in the Middle East.

Conclusions

Among the species of *Allium* sect. *Codonoprasum*, *A. pallens* shows closer relationships with *A. convallarioides*, in having a big size, semicylindrical and fistulous leaves, globose umbel, spathe valves unequal longer than the inflorescence, perigon campanulate with tepals white and small, anthers exserted from the perigon. However, they differ in some morphological features: in particular *A. pallens* has tepals elliptical-oblong to oblong-ovate, truncate or subobtuse at the apex, 4-4,5 mm long, stamens up to 4 mm long, connate into an annulus 1 mm high without interstaminal teeth, anthers rounded at apex, ovary 3-4 mm long, capsule subglobose. Instead, *A. convallarioides* is characterized by tepals oblong, rounded at the apex, 3,5-4 mm long, stamens up to 3 mm long, connate into an annulus 1,2-1,3 mm high with interstaminal teeth, anthers apiculate at apex, ovary 2,8-3 mm long, capsule subglobose-obovoid.

As regards karyological aspects, *A. pallens* is a tetraploid species, while *A. convallarioides* is diploid; however the lack of an arrangement in four chromosome sets in *A. pallens* makes unlikely its autopolyploid origin from populations of *A. convallarioides*. More detailed investigations on meiotic chromosome behaviour and biomolecular studies will be required.

Other differences concern the ecological requirements: *A. pallens* is a synanthropic species, generally occurring in nitrophilous habitats, while *A. convallarioides* is linked to natural environments.

The two species are well distinguished in their geographical distribution too because *A. pallens* is widespread all around Mediterranean area and *A. convallarioides* is circumscribed to the Middle East where it shows a scattered distribution.

Therefore, *A. convallarioides* can be considered the more ancestral unit from which *A. pallens* arised owing to adaptation to synanthropic habitats, thanks to polyploidisation and bulbilliferous vegetative reproduction. Polyploidy, in fact, is an important factor in favouring the colonization of new habitats, such as the secondary ones (Pignatti 1961); moreover the bulblets production makes easier a wide spreading of populations.

Because of close morphological similarity, it is possible to hypothesize that *A. convallarioides* segregated from *A. staticiforme* populations as a result of ecological adaptative strategies.

Acknowledgements

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Appendix

Herbarium specimens examined

Allium pallens

PORTUGAL: Alto Alentajo, Elvas, 24.VII.1972, *Guerra 975* (SEV).

SPAIN: Alava, Alegria, margines de cultivos, 8.IX.1984, *Uribe Echebarria* (MA, BC, SEV, WU); prope Malacam, 1826-1828, *Webb* (FI-WEBB); San Roque, fields and waste placet, 20.V.1887, *Briton-Lee 654* (BM); in aridis et rupestris Calatayud, 30.VII.1912, *Vicioso* (BC); ibid., ad margines agrorum, 7.VIII.1910, *Vizioso* (B); S.ta Caterina, Vinedas, VII.1910, *Font Quér* (BC); entre Mallernosa i Lingola, vores d'un conveu, 16.VI.1958, *O. de Bolos & Masclans* (BC); Jalou (tonagare), caminos, 14.VII.1924, *Gonzalo* (BC); Huesca, Serreta Negra, hacia candasnos, 11.VII.1977, *Molero* (BCF); Sevilla, entre Sanlucar la Mayor y Castilleja del Campo, 20.I.1978, *Pastor & Valdes 44922* (SEV); ibid.

Puebla de Rio, Isla Mayor, Los Mudazales, 21.VI.1974, *Murillo* (SEV); ibid., entrada a los Palacios, 4.VII.1979, *Santo 62201* (SEV); ibid., Universidad Laboral, 11.VII.1978, *Pastor, Talavera & Valdes 44888* (SEV); Cordoba, Cerca de El Tajor, Turra Roja, 7.VII.1982, *Pastor & Valdes 77594* (SEV) typus *A. stearnii*; ibid. entra Peñarroja y Pueblonuevo, 17.VII.1978, *Pastor 44889* (SEV); ibid., Ruta, base de la Sierra Horconesa, 17.VI.1982, *Pastor & Valdes 80270* (SEV); Granada, entre Alcalà y Granada, 26.VII.1977, *Pastor 44234* (SEV); ibid., Padul, 14.VII.1974, *Ruiz Rejon* (SEV); ibid., dry strong round on hill SE of the city, 11.V.1926, *Ellman & Sandwith 633* (K); Caceres, a 6 km del Cruce al Embalse Torrejon, 21.VI.1978, *Devesa & Pastor 49901* (SEV); Cadiz, Paterna, 14.VII.1979, *Pastor 42232* (SEV); Dune di Cadiz, 15.VI.1985, *Brullo* (CAT); Salamanca, Bejar, 21.VI.1978, *Devesa & Pastor 42249* (G, SEV); Teruel, Castelseras, 7.VII.1978, *Devesa, Pastor & Talavera 44891* (SEV); Tarragona, Falset, 7.VII.1978, *Devesa, Talavera & Pastor 44233* (SEV); Antequera, Torcal prov. Malaga, 14.VI.1988, *Valdes et al. 96/88* (SEV); Badajoz, Villanueva de la Serena, 27.VI.1986, *Perez Chiscama* (SEV); in agro prope Badajoz, 16.VII.1891, *Lomax* (OXF, WU); Castilla Candepajares, champ, 11.IX.1909, *Elias* (BM, M); Albacete, in pascuis rupestribus prope Alcaraz, 26.VI.1891, *Porta & Rigo 299* (M); champ de blé, Tolox (prov. Malaga), 29.VI.1910, *Saint Lager* (BM, G); Sito di Luzon prope Matritum, *Peron* (G); Madrid, Aranjuez, 3 km SE of the town, 700 m, saline grasslands, 9.VII.1983, *Gardner 1880* (BM); Prov. Madrid, Vallecas, grasses flats on alkaline clay, by Valencio, high road near Puente de Cevrillos, 14.VII.1972, *Sandwith 6027* (K); La Manca, in agris incultis, VII, *s.l.* (WU); Escorial, 5.VI.1933, *Atchley 264* (K); Sierra Nevada on road to Veleta, rocky hillside in full sun below Cotè Balcan de Canales, 20.VII. 1976, *Malvan, Mason & Snowcombe* (K); Sierra de Cazorla, above Fuente Peloso. 29.VI.1967, *Townsend* (K) ; Castillo de Locuba, IX.1990, *Bartolo & Brullo* (CAT); Majorca, VIII.1988, *Bartolo & Brullo* (CAT).

FRANCE: Mouriés, 13.VII.1853, *Jacquin* (P); dans une vigne à la base de la Garonne de St. Santin de Maurs, 10.VIII.1873, *Hérebeaux* (P); Aveiron, Millau, coteaux et champs calcaires, 28.VIII.1916, *Dufour* (P); Montpellier, *s.d.*, *Gouan* (P); dans une vigne pierreuse prés La Colombine, environs de Montpellier, IX.1845, *Gilone* (P); environs de Montpellier, *s.d.*, *Pourret* (P); La Nouvelle, Aude, 26.VII.1897, *Jauffray* (P); Antibes, Alpes Maritimes, 14.VII.1861, *Thuret* (P); Grenoble, VIII.1839, *Grenier* (P); St. Etienne du Gourg, 1869, *Loret* (P); Marsiglia, a La Rove, 6.VII.1990, *Brullo & Minissale* (CAT); environs de Toulouse, IX.1852, *Huet du Pavillon* (G) ; Nice, VIII.1843, *Reuter* (G); Bouches du Rhône, dans les hoces aux environs de l'étang de Marignano, 12.VIII.1860, *Roux* (G); ibid., Martigues, champs cultivées, VII.1876, *s.l.* (W).

ITALY: Sarzana, ad radices Montis Caprione, prope Il Romito, VII.1827, *Bertoloni* (BOLO); in sepibus ad vineas vallis Bozzal dicta, Tergestium, *Tommasini 44* (BOLO); Modena, Montale (Castelnuovo Rangoni), 29.VII.1932. *Fiori* (PI); Emilia, sul margine dei campi a Cepeleiro di Reno (pr. Bologna), *Baldoni* (FI); nei campi coltivati presso Modena, VIII.1892, *Mori* (B, G, FI, OXF, P, W); nei campi a Casinalbo presso Modena, 28.VII.1883, *Fiori* (FI); Bononia, in collibus prope Monte Padrino, VII.1830, *Bertoloni* (BOLO); in collibus bonon. di Zola Pedrona l. d. Il Grande, 18.VII.1873, *J. Bertoloni* (BOLO); nei colli di Zola superiore l. d. La Fondazza, 23.VII1873, *J. Bertoloni* (BOLO); prope Florentiam, Pian di Mugnone, alle Caldine, 17.VII.1904, *Sommier* (FI); Florentia, in campis, VII.1864, *Caruel* (G); Rapolano, nel Senese (Toscana), in arvis incultis, VII.1873,

Sommier (FI); Arezzo, sotto Savone, nei campi aridi, 16.VIII.1910, *Savelli* (FI); nei campi al Castello presso Firenze, VII.1883, *Martelli* (FI); Livorno, VII.1986, *Bartolo & Brullo* (CAT); Monte Ferrato (Prato) nei terreni ofiolitici, 24.VI.1892, *Martelli* (FI); Capalbiaccio, Maremma Orbetellonese, IV.1894, *Sommier* (FI); Maremma Grossetana, tenuta Acquisti, terreni dell'Ombrone, 20-25.VII.1946, *Corradi & Guicciardini* (FI); ibid., lungo i sentieri presso la Chiesina, 20-25.VII.1946, *Corradi & Guicciardini* (FI); campi presso Pisa, VII.1836, *Savi* (P); Perugia, siepi alla Pallotta, VII.1899, *Palomba* (FI); campi presso Terqueto, 3.VIII.1898, *Palomba* (FI); Alta Val Tiberina, Galini pr. Lugnano, 6.VIII.1934, *Pichi Sermolli* (FI); Via Laurentina, Osteria del Tremante, 17.VII.1983, *Salomonsohn 4265b* (RO); Bisentina, lago di Bolsena, 22.VIII.1877, *Clarisis* (RO); Ladispoli, campo, 20.VII.1897, *Salomonsohn 4265* (RO); alla Colza, nelli prati presso il Tevere, 16.VIII.1857, *Rolli* (RO); in montibus Sabinis, oliveti di Merola, 18.VII.1857, *Rolli* (RO); Roma, sull'aeroporto di Centocelle, VII.1947, *Cacciato* (RO); ibid., Villa Ada, 29.VI.1974, *Anzalone* (RO); Magliano Sabina, VII.1991, *Brullo &* Minissale (CAT); al Carmine di Senigallia, 6.VII.1949, *Bettini* (FI); ad radi Montis Morrone, prope Sulmona, 30.VII.1873, *Levier* (FI); in lapidosis inter campos prope Massa d'Alba ad rad. Montis Velino, 12.VIII.1875, *Levier* (FI); Pescara, *Kuntze* (FI); Gallipoli, VI.1984, *Brullo* (CAT); Lucania, Pignola in herbis loco Pantani vocato, 4.IX.1933, *Gavioli* (FI); ibid., Potenza, in vinei loco Mancanese dicto, 1800 m, VII.1892, *Raviolo* (FI); Basilicata, Potenza, 12.VI.1984, *Brullo* (CAT); ibid., 19.VII.1985, *Brullo* (CAT); Castrovillari, VII.1885, *Terraciano* (RO); Valle del Lao, sopra un muro a Maurogianni, Laino Borgo, 18.VII.1892, *Longo* (RO); Calabria, a Reggio, 1828, *Gussone* (BOLO); ibid., Aspromonte, Saline ioniche, 26.VI.1996, *Brullo & Spampinato* (CAT); ibid., Monte Mula, 19.VII.1985, *Brullo* (CAT); Trebisacce, VII.1988, Brullo (CAT).

SICILY: Sicilia, *Gasparrini* (G, P); Partinico, *Tineo* (FI-WEBB) type of *A. coppoleri*; in arvis et inter segetes prope Partinico in Sicilia, *Tineo*, (FI-WEBB); prope Panormum, *Tineo* (P); Palermo, *Tineo* (K); Palermo, *Parlatore* (FI-WEBB); prope Drepanum, *Tineo* (P); Levanzo (Trapani), 5.VII.1982, *Brullo* (CAT); Modica, San Giacomo, 18.VI.1983, *Brullo* (CAT); Biancavilla, 4.VII.1983, *Brullo* (CAT); ibid., 8.VI.1984, *Brullo* (CAT); Lampedusa, Sanguedolce, 24.VI.1985, *Brullo, Minissale & Spampinato* (CAT); ibid., Vallone Madonna, 25.VI.1985, *Brullo, Minissale & Spampinato* (CAT); Calanchi Schettino (Paternò), 8.VI.1984, *Brullo, Minissale & Spampinato* (CAT); Etna, colline argillose sotto Adrano, 21.VI.1993, *Brullo* (CAT); Prizzi, Pian del leone, 12.VII.1995, *Brullo* (CAT).

CROATIA: Pola, Hecken bei Veruna, 10.VII.1904, *Vutchy* (PRC); ibid., 1864, Kerner (WU); su macerie in Manichetta, pr. Lussinpiccolo, 6.VIII.1932, *Lusina* (RO); Volosca Preluko in declivibus ad viam Flumensem, 26.VII.1899, *Evers* (WU); Insel Arbe, an ein Flyschmaner bein Kloster S. Eufemia, 20.VII.1911, *Morton 550* (WU); ibid., Flyschfelsen bein Kloster S. Elia, 27.VII.1912, *Morton 551* (WU); Lussin Grande, VII.1904, *Makansky* (WU).

GREECE: in saxosis pr. Mycenes, *Heldreich 2562* (P, PI); in campis prope Mycenas (Argolidis), *Sartori* (FI); ad margines agrorum inter Argos et Mychene, VI.1834, *Sartori 2562* (G-BOISS); Mykene, *s.d.*, *Zuccarini* (M); Mycene, IX.1989, *Brullo* (CAT); Macedonia, Hortiac Distr., 17.VII.1918, *Ramsbottom* (BM); Attica, in vinetis prope Ano-Liosia, 12.VII.1897, *Heldreich 1494* (B, G, K, M, OXF, P, PRC, WU); ibid., mt. Parnas,

VI.1934, *Guial* 2574 (BM); ibid., prope Agios Andreas, VII.1930, *Guial* 1608 (BM); ibid., pr. Eleusini, IV.1876, *Pichler* (K); Sterea Hellas, Attiki, Kifissia, Kefalari, at the edge of the road, 9.VII.1974, *Zahariadi* (ATH); ibid., Kifissia, waste ground, 9.VII.1974, *Zahariadi* (ATH); in Euboea septentrionali pr. Kurbatz, *Wild* (P); Nauplia, *Schultes* (M); ibid., *Berger* (K); ibid., 5.VI.1836, *Zuccarini 119* (K); in vinetis circa Neauplia, Peloponnesi prope Arion, 21.VI.1850, *Orphanides 1289* (G-BOISS); prope Athenas in horto Chasaki, VII.1864, *Orphanides 468* (G-BOISS) ; in ulivetis Piraei, VI.1848, *Orphanides 300* (G-BOISS); in regione inferiori M. Parnassi, p. Rochova, 26.VII.1856, *Heldreich 3208* (G-BOISS, K); Peloponneso, Korintho, in arvis derelictis et ad margines vineorum, 8.VIII.1974, *Charpin et al.* (G); dried Pine forest, 5 km N of Kalithea to Vamvakou, Peloponneso, 1020 m, 22.VII.1980, *Sakamote & Kobayashi* (K); Chrysso, Phocide, 26.VI.1896, *Saint Lager* (G); Zante, VI-VII.1837, *Margot 505* (G); Insel Kios, Epos, 29.V.1938, *Hubert-Morath 2820* (G); Insula Mytilini (Lesbos), in arenosis Pachys Ammos prope Kalloni, 18-24.V.1934, *Rechinger 5913* (G); ibid., montes Lepetymnos in declivibus siccis inter Gelia et Ypsilometapon, 18-24.V.1934, *Rechinger 5763* (G); Insula Rhodos, in mont. Prophet Elias prope Salakos, in saxosis calcareis, 2.V.1935, *Rechinger 7151* (G); grows from bulbs coll. Rhodos, 1935, *Rechinger 7151* (K); in ulivetis ad urbem Amphipon (Salona hodie), 15.VII.1888, *Halacsy* (WU); Kanali, Corfù, 25.VII.1894, *Formanek* (WU); Calipsos (Kavala), 12.VI.1986, *Brullo & Pavone* (CAT); tra Krini e Paradisos, 20.VI.1987, *Brullo, Pavone & Signorello* (CAT); Kavala, negli incolti, 13.VII.1989, *Brullo* (CAT); Delfi, Arachova, roadside, 21.VIII.1960, *s.l.* (HJU); ibid., es. colt., 16.VI.1990, *Brullo* (CAT); Antiparos, Akr. Akakos, 13.VI.1995, *Brullo & Minissale* (CAT).

CYPRUS: Famagusta, in litore inter opp. Famagusta et Salamis, 9.VII.1939, *Lindberg* (HJU, K); Capo Drepanon (es. colt.), 18.VI.1992, *Brullo* (CAT); Parapedhi, Mandria, 21.VIII.1937, *Kennedy 185* (B); inter Peristemona et Potami, 14.VI.1880, *Sintenis & Rigo 869* (G, P); Athalassa pr. opp. Nicosia, in decl. lapidos. siccis, 6.VI.1939, *Lindberg* (K, W); Pyla, Larnaka district, in marshy fields, 8.VI.1934, *Syngrassides 432* (K); Akna Faest, in the nursery garden on terra rossa, 28.V.1952, *Merton 839* (K).

MOROCCO: Ouigon, sud ouest Maroc, 1865, *Mardacheé* (P); Fez, Dar Mahares, coteaux argileux, VII.1913, *Mouret 2154* (MPU); Anti Atlas, Igrem, 10.VI.1992, *Brullo & Signorello* (CAT).

ALGERIA: coteaux sabloneux à l'Est d'Oran, 11.VI.1852, *Balansa 227* (FI-WEBB, P); environs de Biskra, champ cultivé, VI.1852, *Jamin* (P); champs à Bini Mora prés Biskra, 4.VI.1852, *Jamin* (P, FI-WEBB); Alger, prairies prés de la Rezhaya, VI.1837, *Bovet* (FI-WEBB); environs de Djelfa, prov. Alger, VI.1864, *Reboud* (P); maison Carrée (Alger), 1893, *Duval-Jouve 1407* (P).

TUNISIA: in arboretes Zaghouan, 19.VII.1854, *Kralik* (P); Parc National du Ichkeul, reclaimed marsh alluvial loam, 1978-79, *Fay 1494* (K).

EGYPT: Helwan ad Nili ripa, III.1903, *Muschler* (K); Mariout près Alexandria, 1.V.1890, *Schweinfurth 318* (K).

ISRAEL: Ramlah, 1857, *Roth 1431* (G-BOISS; FI-WEBB, M); Upper Galilee, E of Hermon, near Pinus forest, among rocks, 29.VI.1966, *Kollmann* (HJU); ascent from Wady Limun, 7.VI.1926, *Zohary* (HJU); Sharon Plain, Binyamine to Shuni, 23.VI.1029, *Eig, Zohary & Feinbrun* (HJU); Neveh Jarak, 19.VI.1958, *Zohary & Orshan* (HJU);

Binyamine to Caesarea, 27.VI.1929, *Zohary* (HJU); env. of Yargon River, 1.VI.1960, *Zohary* (HJU); Mikhmoret, 17.VI.1972, *Zohary 1155* (HJU) ; Wadi Faliq, 1.VI.1960, *Zohary* (HJU); Jordan Valley, Gesher Buat Jacob roadside, 3.VI.1972, *Kollman* (HJU); Philistean Plain, Rehovoth, crop field, V.1967, *Koller* (HJU); ibid. Ramat Gan, 22.VI.1929, *Eig, Zohary & Feinbrun* (HJU); ibid. Nahlat Yehuda, sandy loam soil, 25.V.1924, *Eig* (HJU); ibid. Wadi Rubin, VI.1960, *Zohary* (HJU); Golan, near Baniyas, 19.VII.1967, *Kollmann 459* (HJU); ibid., Nuheila, springs 2 km N of Tel Dan, 7.VII.1973, *Shmida 1219* (HJU); between Ein Kanya and Kalaat Nimrod, 3.VII.1967, *Peri & Danin 437* (HJU); env. of Tel Aviv, Ir Ganim, sandy loam soil, 29.V.1924, *Eig* (HJU).

TURKEY: Troja, Seitinly in vinetis, 25.VI.1883, *Sintenis 663* (G, K, P, PA, WU); Istanbul, Cümüsaha , *s.l.* (HJU); A5 Sinop: Duragan-Vezirkoprii, 30.VII.1983, *Ozhatay 51932* (ISTE); Costantinopole, San Stefano Diakrikerny, 25.VII.1898, *Aznavour 2204bis* (G); Istanbul, Tekir Dag to Istanbul, 500 m, to Gümüsyaka, *s.d., N. & E. Ozhatay 33051* (BM); plage sablonneuse à l'Est des salines de Smyrne, 3.VI.1854, *Balansa 390* (C, G); in arenosis ad Smyrnam, 3.VI.1854, *Balansa* (C); Smyrna, *s.d., s.l.* (K); Karatas, S of Adana, sea level, 7.VI.1960, *Guichard 126.60* (K); Antalya, 26.VI.1958, *Truman 247* (K); Kusadasi, cliffs above sea, *s.d., Horton 1257* (K); Didime, VII.1987, *Brullo, Pavone & Signorello* (CAT); Amanus Mountain, env. of Hagi Ahmadly, 2.VII.1932, *Eig & Zohary* (HJU).

SYRIA: Jebel-ed-Drouz, env. of Suweida, 1250 m, basalt soil, 20.VI.1932, *Eig & Zohary* (HJU); Den Baalbe (betw. Hama and Maaret), 560 m, follow fields, 26.VII.1932, *Eig & Zohary* (HJU); prés du Nehr Mellech (sud du Gouv. de Lattaquier), 24.VI.1934, *Gombaut 511* (P).

LEBANON: entre Rachaya et Qaraun, 12.VII.1957, *Pabot* (G); Sud de Deirik (Bu de Canard), 24.VI.1956, *Pabot* (G); Terrail (Bekaa), 29.VII.1953, *Mouterde 10908* (G); ibid., 8.VII.1932, *Mouterde 1312* (G); Beyrut, 6.VI.1867, *Post 1011* (K); Maallaga, 2.VIII.1931, *Gombaut 6303* (P).

Allium convallarioides

TURKEY: Anatolia occidentale, Gordes in Trudos in pinetis herbosis, solo arenoso, 16.VI.1933, *Schwarz 734* (B); Bafa Golu, Milas, 25.VI.1989, *Brullo* (CAT); Izmir, Kemalposa Nifdagi, c. 1500 m, 6.VII.1969, *Yildiz 7417* (HJU); ibid., Hügel NE von Bornova, 1.VII.1969, *Fitz & Spitzenberger 1001* (W); Maras, 10 km N Andirni, 1000 m, 1.VI.1973, *Sorger 731456* (W); Manisa Dag, 19.VI.1998, *Brullo & Pavone* (CAT); Menemen (Izmir), 19.VI.1998, *Brullo & Pavone* (CAT); Taurus cataonicus, 19.VII.1865, *Haussknech* (G-BOISS); Magnesia, VIII.1854, *Balansa 782* (G); Cilicia: Gaensin lehmige Ortex, 1869, *Siehe* (G); ibid., Icel Gulnar, 8.VI.1950, *Huber-Morath 10365* (G); Urfa, dist. Viransehir, 22.V.1956, *Huber-Morath 14413* (G); in monte Sypile, *Aucher-Eloy 2203* (G, P); Yozgat to Yildizeli, 22 km W Karayollari Addurahmanli Bakimeri, grassy ground at a hill, 16.VIII.1971, *Bothmer & Buttler 1557* (C).

IRAN: Persia, Tschekur Katum Berge Roswend, 28.7.1892, *Strauss* (B); ibid., Sultanabad in m. Rasweut, 28.7.1892, *Strauss* (B, WU); 7 miles N of Keriad, damp soil, 5600 ft., 17.VIII.1963, *Corley 43* (OXF).

IRAQ: Assyria orient. inter Erbil et Riwandous, 17.7.1893, *Bornmüller 1870* (B, K); Sersong, 7.VII.1975, *Wrcekw Heynes 570* (K); 9 km from Kaarta to Serser, 1270 m, 26.VII.1973, *Noorie & Hammal 41267* (K); Isjndari Saddle, Savarotuka, 1250,

11.VI.1958, *Chapman 26313* (K); hillside between oaktrees, 1.VII.1979, *Omar al Kaisi & Hamad 45760* (K); Sawara Tuka, 25 km SW de Amadya, 11.VII.1976, *al Kaisi & Hamad 45847* (K); Dainika Village, 35 km NE Zakho, 5.VII.1976, *Kaisi & Hamad 45354* (K); Dairalok Village, 16 km E Amadya, 12.VII.1976, *al Dulbagh & Hamad 45879* (K).

TURKMENISTAN: Turkomannia in agri incultis prope urb. Kara-Kala, 5.7.1931, *Linczevski 5435* (G, W); Kisil-Arwat, Karakala in campis prope pagum Arabdschik, 24.VI.1901, *Bornmüller 1987* (B, BM, K, PRC, W); ibid., *Sintenis 1987* (P).

ARMENIA: pr. et dist. Erivan prope Dzhirvish in siccis, 20.7.1919, *Grossheim 107* (K, G, PR).